Aerobic composting reduces antibiotic resistance genes in manure and the resistome dissemination in agricultural soils

Mukesh Kumar Awasthi [1, 2], Zengqiang Zhang[1*]
[1]College of Natural Resources and Environment, Northwest A&F University, Yangling, Shaanxi Province 712100, PR China
[2] Swedish Center for Resource Recovery Department of Biotechnology, University of Borås, Borås, Sweden
* Presenting author email: mukesh_awasthi45@yahoo.com

Abstract

Composting has been suggested as a potential strategy to eliminate antibiotic residues and pathogens in livestock manure before its application as an organic fertilizer in agro-ecosystems. However, the impacts of composting on antibiotic resistance genes (ARGs) in livestock manure and their temporal succession following the application of compost to land are not well understood. We examined how aerobic composting affected the resistome profiles of cattle manure, and by constructing laboratory microcosms we compared the effects of manure and compost application to agricultural soils on the temporal succession of a wide spectrum of ARGs. The high-throughput quantitative PCR array detected a total of 144 ARGs across all the soil, manure and compost samples, with Macrolide-Lincosamide-Streptogramin B, aminoglycoside, multidrug, tetracycline, and β-lactam resistance as the most dominant types. Composting significantly reduced the diversity and relative abundance of ARGs and mobile genetic elements (MGEs) in the cattle manure. In the 120-day microcosm incubation, the diversity and abundance of ARGs in manure-treated soils were significantly higher than those in compost-treated soils at the beginning of the experiment. The level of antibiotic resistance rapidly declined over time in all manure and compost-treated soils, coupled with similar temporal patterns of manure- and compost-derived bacterial communities as revealed by Source Tracker analysis. The network analysis revealed more intensive interactions/ associations among ARGs and MGEs in manure-treated soils than in compost-treated soils, suggesting that mobility potential of ARGs was lower in soils amended with compost. Our results provide evidence that aerobic composting of cattle manure may be an effective approach to mitigate the risk of antibiotic resistance propagation associated with land application of organic wastes.

Keywords: Antibiotic resistance genes; Manure; Aerobic composting; Human health; Resistome.